

*“...due to the OH hydroxyl radicals **trapped** in the bulk of magnesium peroxide” [Introduction, 3rd paragraph, left column]*

*“The paramagnetic species giving rise to the spectrum in Figure 2 are **located in the bulk** of the solid. This can be stated because the line broadening shown by surface radical species when the EPR spectrum...is not observed in the present case” [page 5736, 2nd paragraph, left column]*

*“The data reported in the present paper suggest an assignment of species I to an OH radical **trapped in the bulk...**” [page 5739, 2nd paragraph, left column]*

*“...with three distinct paramagnetic species (i.e. the OH hydroxyl radical, and the O<sub>2</sub><sup>-</sup> and O<sup>-</sup> radical ions) simultaneously formed and **trapped in the bulk** of magnesium peroxide” [page 5739, 4th paragraph, right column]*

*“As to the first radical, it is noticeable that, being **isolated in the ionic MgO<sub>2</sub> matrix**, it displays... To the best of our knowledge this is the first observation of a **stable hydroxyl radical in a nonaqueous matrix...**” [Conclusions]*

Thus, while being perhaps stable, the hydroxyl radicals are trapped and isolated within the MgO<sub>2</sub> matrix.

Thus, the concentration of a reactive radical obtained according to Giamello et al. would be too low to be used in any chemical reaction, such as treatment of a liquid aqueous biocidal mixture. This was also confirmed by Applicant who did not detect percent of SA conversion when using any hydroxyl radicals in a H<sub>2</sub>O<sub>2</sub>/MgO system. In other words, any attempt to use the trapped radicals provided by Giamello et al. would be inefficient and essentially ineffective.

Against this, the quadruplet combination of MgO/H<sub>2</sub>O<sub>2</sub>/O<sub>2</sub>/UV according to the present invention allows the formation of hydroxyl radicals **on the surface of the MgO particles** that are available for use in the treatment of the liquid aqueous biocidal mixture. Further, the quadruplet combination allows the enhanced generation of the hydroxyl radicals on the surface of the MgO particles to an extent that they are available to provide an enhanced treatment of the biocidal mixture.

*“These authors [a.k.a., the inventors of this application] also observed a highly **unexpected stability** of hydroxyl radicals **adsorbed on the MgO surface**, wherein the radicals were stable at temperatures as high as 200°C.” [paragraph 0017, in the present application]*

The application distinguished that MgO is not a trapping agent under this application; instead MgO's surface provides the area that allows the hydroxyl radicals to be generated and later reacted to a trapping agent like salicylic acid.

*“Hydroxyl radicals may be quantified by physical or chemical methods known in the art, such as measuring redox, or reacting hydroxyl radicals with a trapping agent such as salicylic acid, etc.” [paragraph 0029]*

While Giamello et al. may teach the use of  $\text{MgO}/\text{H}_2\text{O}_2$  **for generating stable, trapped radicals**, those Giamello stable, trapped radicals are unavailable and ineffective for use as a reagent for treatment of a liquid biocidal mixture since the radicals, as taught by Giamello et al., are trapped in the  $\text{MgO}$  matrix.

With respect to Giamello et al. we would also like to clarify that the stability is due to the entrapment of the radicals within the matrix and thus the ineffectiveness would not be dependent on concentration, as apparently considered by the Examiner. Even if different concentrations, e.g. higher concentrations are used, in the absence of other reagents, such as in the present invention, the resulting species would still be trapped in the matrix.

The Examiner combined Giamello et al. to Coury et al.’s teachings. The Examiner makes reference to Figure 9 and states that the  $\text{MnO}_2$  may easily be replaced by  $\text{MgO}$ , taught by Giamello et al.

However, the Examiner’s statement is entirely baseless since Mn and Mg are two entirely different chemical entities.

As appreciated, Mn is a transition metal while Mg is an alkaline earth metal and one cannot deduce from an effect or use of a transition metal on an effect to be achieved from an alkaline earth metal. For example, while  $\text{MnO}_2$  is known as an oxidizing agent,  $\text{MgO}$  is not.

However, for the sake of argument, even if the  $\text{MgO}$  suggested by Giamello et al would have been considered by a man versed in the art as replacement for  $\text{MnO}_2$  in the system and method of Coury et al., one would still not reach the invention subject of the present invention.

The present invention provides **a single pot reaction method**, where all components are added to the same reaction mixture. This is evident from the Examples, and the claims, which make use of **a single beaker into which the reaction components are added**:

*“Reaction was carried out in a one liter beaker equipped with a stirrer” [See Example 1].*

Against this, Coury et al. teach a multi stage system including at least three compartments, *feed tank*, *first station vessel* and *media station*, interconnected by communication means and pumps. Further, Coury et al. emphasizes the need for the reaction to be conducted under pressure and that the pressure needs to be maintained while fluid is communicated between the stations.

*“In accordance with the present invention, it has been newly discovered that, in multiple zone extractors, separating the exhaust gas in the high concentration zone from the low concentration zone with intermediate capture, remixing and reinjection of substantially all the high concentration exhaust gas into the water entering the low*

*concentration zone with subsequent venting to the atmosphere of the "double-scrubbed" exhaust gas provides unexpected benefits"* [column 7, lines 19-27]

In addition, it is clear from Coury et al. that pressure is required in order to provide an effective free radical production.

*"Surprisingly, it was also discovered that **increasing the reactor pressure stimulated the production of free radicals**"* [column 14, line 52]

Furthermore, one reading Giamello et al. would not have been expected to obtain free radicals, as desired by Coury et al. as the former explicitly states that the radicals are entrapped in the MgO matrix. However, Coury et al. requires the formation of free radicals and not trapped radicals.

Thus, considering all the above it would not have been obvious to combine the teaching of Giamello et al. of the production of stable, trapped radicals, for use in the method of Coury et al. so as to obtain in a simple, "single pot" reaction, enhanced generation, as defined in the claims, of stable hydroxyl radicals, which may be utilized for the treatment of the liquid:

*"These authors also observed a highly unexpected stability of hydroxyl radicals adsorbed on the MgO surface, wherein the radicals were stable at temperatures as high as 200°C."*  
[paragraph 0017].

The Examiner then refers to Jen et. al. and Zhou et. al. to address dependent claim limitations.

Jen et al. merely describe a method for determination of hydroxyl radicals with salicylic acid; Zhou et. al. merely describes the photoproduction of OH radicals in natural water and other liquids.

Neither Jen et al. nor Zhou et. al. teach or add to the teaching of Coury et al. or Gimello et al. for providing enhanced production, as defined in the claims, of stable OH radicals.

Following the above explanations, and the effected amendments, the Applicant respectfully requests favorable reconsideration and allowance of the claims, as all raised objections and rejections have been duly addressed.

Respectfully submitted

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